PLANNING AID REPORT

on the

PRINCEVILLE FLOOD DAMAGE REDUCTION PROJECT

EDGECOMBE COUNTY, NORTH CAROLINA

Prepared by

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under the Supervision of:

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Section 1 Introduction

The Princeville Flood Damage Reduction Feasibility Study is being carried out under the Corps of Engineers' General Investigation (GI) Program. The purpose of the feasibility study is to develop and evaluate alternatives for implementing solutions to flooding and related problems for the town of Princeville, Edgecombe County, North Carolina.

As provided by the Corps to the Service on June 19, 2003, the project purpose and authorization are described as the following:

"The purpose of this plan is to define and manage the development of a feasibility study to generate and evaluate alternatives for implementing solutions to provide future flood protection for Princeville, North Carolina. During this feasibility study participants will be mindful of the unique cultural and historical values of the community and the importance of providing a level of protection against flooding at least sufficient to prevent any future losses to this community from the likelihood of flooding such as occurred in September 1999 due to torrential rainfall from Hurricane Floyd. The feasibility study will be conducted in response to Public Law 106-246, dated July 13, 2000, which reads as follows:

> " "For an additional amount for "General Investigations", $3,500,000, to remain available until expended, of which $1,500,000 shall be for a feasibility study and report of a project to provide flood damage reduction for the town of Princeville, North Carolina, and of which $2,000,000 shall be for preconstruction engineering and design of an emergency outlet from Devils Lake, North Dakota, to the Sheyenne River: Provided, That the entire amount is designated by the Congress as an emergency requirement pursuant to section 251(b)(2)(A) of the Balanced Budget and Emergency Deficit Control Act of 1985, as amended." "

Purpose and Authority

The purpose of this Planning Aid Report (PAR) is to provide planning information for the Princeville Flood Damage Reduction Project, Edgecombe County, North Carolina, conducted by the U.S. Army Corps of Engineers, Wilmington District (Corps). This report provides planning aid information with respect to: (1) fish and wildlife resources which may be affected by the major action alternatives; (2) fish and wildlife resource problems, conservation opportunities, and planning alternatives of the project; (3) anticipated project related impacts to fish and wildlife resources; (4) data needs of the Service for our Section 2(b) report; and, (5) U.S. Fish and Wildlife Service (Service) recommendations for future planning. Overall the Service seeks to identify alternatives or design features and construction techniques of a given alternative that will conserve and enhance fish and wildlife resources and avoid and/or minimize adverse impacts to these resources. This PAR is provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat., as amended: 16 U.S.C. 661-667d), but does not constitute the Section 2(b) report of the Service required by the FWCA.

Scope

The geographic scope of this report includes all areas that would be directly or indirectly impacted by the major alternatives for flood damage reduction along the Tar River near Princeville. The project area includes not only the Tar River adjacent to Princeville, but those areas upriver and down river of Princeville which could be hydrologically affected by flood control alternatives. The project area also includes uplands that could be used to relocate structures away from the most vulnerable flooding area. In all cases these areas represent habitat for fish and wildlife resources, and these resources will be considered.

The temporal scope of this report extends from direct, immediate impacts of potential flood damage reduction measures to long-term, indirect impacts that may occur as a result of these measures. The report also considers the cumulative impacts of major structural alternatives.

Section 2. Project Area Description

Location

Princeville, located in Edgecombe County, North Carolina, is a town surrounded on two sides by the Tar River (Figure 1). The town of Tarboro is located across the river on the north side of Princeville. Edgecombe had an estimated population of 55,007 people on July 1, 2002 (U.S. Census Bureau 2003a). Princeville has a population of approximately 940 people (U.S. Census Bureau 2003b). The elevation of the town is between 10 and 15 feet above mean sea level. Princeville is located within the floodplain of the Tar River and was extensively flooded following the storms of September 1999 (which included Hurricanes Dennis, Floyd and Irene).

Figure 1. Princeville is located in Edgecombe County along the Tar River (shown in blue). Tarboro is located across the river to the north. The river flows from upper left to lower right in the photo. Locations are shown on a 1998 color infrared aerial digital orthophoto quadrangle from the U.S. Geological Survey.

Major Biological Communities

Recent research suggests that the wetland environments in northeastern North Carolina river basins are controlled more by their geomorphology than by soil drainage capacity like other wetlands. The Roanoke, Tar and Neuse River watersheds are unique along the Atlantic coast, with no correlative from Maine to Florida. These systems have not been compatible with other classification and management schemes. Freshwater tidal marsh community types, the subcanopy and herb layers of headwater wetlands, marine terraces, and the system's response to rising sea level all differ from the adjacent river basins to the north and south.

The Outer Banks form the second largest estuarine complex in the United States. This thin ribbon of sand forms a natural dam that controls salinity, water levels and water exchange in the estuaries and lower river basins. These basins are not tidally influenced like the Cape Fear to the south. The geometry of the cape structures and the low gradient of the coastal plain create an ecosystem unlike any other on the Atlantic coast. The ecosystems provide primary nursery, migratory and overwintering areas for waterfowl, wading birds, colonial nesting waterbirds, neotropical migrants, anadromous fish, and Federally-protected species (e.g., sea turtles, marine mammals, mussels). Diverse habitats include estuarine marsh, submerged aquatic vegetation (SAV), bottomland hardwood wetlands, cypress-tupelo swamps, and pocosins.

The spatial distribution of riverine floodplain, wetland and estuarine habitats have been mapped. The frequency and duration of flooding events and their controls on each of these habitats, however, remains uncertain. Parameters thought to influence habitat hydrology include groundwater input, precipitation, tides (storm, wind and diurnal), climate, mean sea level, geomorphology and underlying geology.

There are several of these major habitat types that require consideration in the Princeville project area, including both aquatic and terrestrial resources. According to the North Carolina Gap Analysis Program (NC GAP), the non-fluvial biological communities found in Edgecombe County along the Tar River corridor and its tributaries include:

- Cypress Gum Floodplain Forest,
- Coastal Plain Oak Bottomland Forest,
- Pocosin Woodlands and Shrublands,
- Coastal Plain Mixed Bottomland,
- Peatland Atlantic White Cedar,
- Coastal Plain Non-riverine Wet Flat Forest,
- Seepage and Streamhead Swamp, and
- Piedmont Mixed Successional Forests.

Schafale and Weakley (1990) provides descriptions of these community types. These biological communities exist in a complex mosaic of habitats; many of them are wetland communities that are hydrologically connected to the Tar River and its tributaries. Each provides valuable habitat

to fish and wildlife resources. Fragmentation of the habitats may be caused by agricultural and urban development, management of cultivated plantations, and mining activities.

Underlying Physical Setting of the Project Area

The Tar River basin encompasses 195 river miles from Person County to the Pamlico River estuary in Beaufort County (Smith and Bayless 1964). The river basin is asymmetrical, with the main stem of the Tar River on the southern side of the basin and most of its drainage area to the north (Figure 2). The largest tributary to the Tar River is Fishing Creek (Smith and Bayless 1964), which drains into the Tar River at Tarboro. The second largest tributary is Swift Creek (Smith and Bayless 1964), which also drains into the Tar just upstream of Fishing Creek near Tarboro. The Deep Creek tributary merges with Fishing Creek immediately upstream of the latter's confluence with the Tar. Consequently, three large tributary watersheds converge on the Tar River in Edgecombe County in the vicinity of Tarboro and Princeville.

The fluvial morphology of the Tar River appears to be influenced by its underlying geology. Riggs and Ames (2003) have drafted the best available data on the underlying geology of the Tar River basin, noting that the sinuosity and width of the floodplain vary with the different substrates thought to exist in the basin (Figure 2). The river passes through granite north of Rocky Mount, as evidenced by the granite quarry in the second meander downstream of the town. This section of river has granite boulders as part of its substrate. The river descends off this granitic substrate at the dam and Upper Falls east of 301 in Rocky Mount (Figures 2 and 3; Riggs and Ames 2003).

From Rocky Mount to Tarboro, the river appears to be governed by a paleo meanderplain that is no longer active. This stretch of river flows through riverine sand and gravel deposits that are thought to be Cretaceous in age. The presence of a sand and gravel substrate is thought to allow the (historic) fluvial morphology of meanders (Riggs and Ames 2003).

Near Tarboro the character of the Tar River changes, probably reflecting the input of the Swift and Fishing Creeks tributaries (Riggs and Ames 2003). The gradient of the river changes, likely as a result of the input of sand from the two tributaries, which flow along the Surry Scarp and carry a lot of sediment into the Tar (Figure 3). The river orientation takes a sharp bend to the south at Tarboro, almost at a right angle. Two more bends to the east and then south occur at Princeville, forming a box-like shape. Thus the immediate project area of Tarboro and Princeville are located at a distinct change in the river's morphology. These sharp bends, along with a comparative straightening of the river downstream of Princeville, is thought to be a reflection of a change in the underlying geology (Riggs and Ames 2003). From Tarboro to Greenville the Tar River is incised with steep bluffs along the river banks in many locations. East of Greenville the river approaches mean sea level and is influenced by the Pamlico River estuary. The salt wedge reaches Grimesland during normal years but can reach Greenville during dry years (Riggs and Ames 2003).

The Tar River floodplain is thought to be unique in its geomorphology, with the Roanoke and Neuse Rivers the closest in character (Brinson and Riggs 2001). River basins to the north (Virginia and north) and the south (Cape Fear River and south) are unlike the Tar-Pamlico basin. The floodplain(s) of the Tar River appear to reflect at least four distinct ages, or periods of history (Figure 4). The Upper Terrace is probably the oldest of these floodplains, and is characterized by a high bluff more visible on the north side of the floodplain than on the southern (Figure 5). The Upper Terrace separates the upland areas from the various floodplain habitats (Riggs and Ames 2003). The town of Tarboro straddles the Upper Terrace (Figure 4).

Within the limits of the Upper Terrace, a paleo-meander plain is located within the paleo-braidplain and probably occurred during different climatic conditions. This meanderplain is generally found at 14 to 18 meters (m; 46 to 59 feet (ft) in elevation above present sea level in the vicinity of Tarboro. It is of unknown age, but its features are distinguishable on aerial photography of the region. The paleo-meanderplain is most visible along the river between Rocky Mount and Tarboro. An example of an abandoned meander is present at Falling Run Branch (Riggs and Ames 2003).

Inset into the paleo-meanderplain, a paleo-braidplain distinguishes the geomorphology of the floodplain. This braidplain likely formed during a different climate than today's climate, and reflects a period of history when the Tar River was a braided system full of sediment. The braidplain may be interglacial in age (e.g., greater than 30,000 years before present (BP)). At Princeville, the paleo braidplain is 12 to 14 m (39.3 to 45.9 ft) in elevation, and the town sits entirely within the braidplain (Figure 4; Riggs and Ames 2003). The low-lying areas between the sandbar ridge and swale topography of the braidplain are thought to control the distribution of wetland habitats (Brinson and Riggs 2001).

Finally, the present Tar River is incised within the paleo-braidplain (Figure 5). The only classically described active floodplain is found downstream of Greenville, and then the floodplain is perched 6 m (20 ft) above the river and is only flooded in large storm events (Riggs and Ames 2003).

The variation in the geomorphology of the Tar River floodplain(s) are thought to control the hydrology of its habitats, creating wetlands that are comparably unique in character. Grindle Pocosin, for instance, is perched on the Upper Terrace on the northeast side of the river between Princeville and Greenville. Many smaller wetlands are oblong in shape and oriented in alignment with the paleo-braidplain channels (Brinson and Riggs 2003). Relatively small rainfalls (2 inches) are enough to keep some of these wetlands wet for half of the year (Riggs and Ames 2003).

Constrictions on the Tar River Floodplain

There are several natural and man-made constrictions on the Tar River floodplain (Figure 6).

Grindle Pocosin is an example of a natural constriction, forming a chokepoint on the floodplain that backs up floodwaters towards Princeville (Figure 6). Several road dams in Greenville form man-made constrictions on the Tar River floodplain, backing floodwater upstream during large storm events. The bridge at the Greenville airport, for instance, probably blocks 75% of the floodplain conveyance. The bridge at Hastings Ford may block 90% of the floodplain conveyance, forming a potentially more serious flooding problem upstream of Greenville (Riggs and Ames 2003).

In the Tarboro-Princeville area, the existing dike around Princeville constricts the Tar River floodplain. The input of the Swift, Fishing and Deep Creek watersheds immediately north of Princeville convey a significant discharge. The current channel of the Tar River bends around Tarboro, but the paleo-braidplain floodplain bypasses the second and third bends of the river to pass straight through Princeville. A natural narrowing of the floodplain southwest of Princeville forms another constriction on floodwaters. The road dam formed by NC 64 on the south side of Princeville effectively precludes any outlet for water flooding the town from the north and east (Riggs and Ames 2003).

Thus Princeville was substantially flooded from behind the dike (from the east) during the 1999 flooding event (Figure 6). The floodwaters from behind the dike rose almost as fast as those of the Tar River, such that when the dike was overtopped by the Tar River the dike survived with scallops and deltaic fans on the interior side (where Tar River floodwaters met standing water on the backside of the dike). In addition, the floodwaters remained in Princeville longer than would have naturally occurred without the dike or NC 64 road dam and had to be pumped out (Riggs and Ames 2003).

The town of Speed faced a similar problem during the 1999 flooding event. A three-sided dike protects Speed, which is upstream of Princeville on Deep Creek. Road dams in and around Speed led to backside flooding, leaving a reservoir of floodwaters after the event had passed. Streams upstream of Speed have been channelized, and the smaller watersheds tend to have steeper gradients that respond to large precipitation events (e.g., 4 - 6" of rainfall) with flash floods (Riggs and Ames 2003).

The flooding problems experienced in towns like Princeville and Speed suggest that dikes, road dams, and stream channelization may contribute significantly to the frequency and duration of flooding in these communities. The geographic orientation of the two largest tributaries to the Tar River, merging with the main stem immediately upstream of Princeville, create a set of conditions that are challenging to control local flooding. The underlying physical setting of this area and the natural and man-made constrictions on the floodplain suggest that flooding may never be entirely prevented, but may be minimized in duration and frequency if project designs take advantage of natural conditions and processes in the project area.

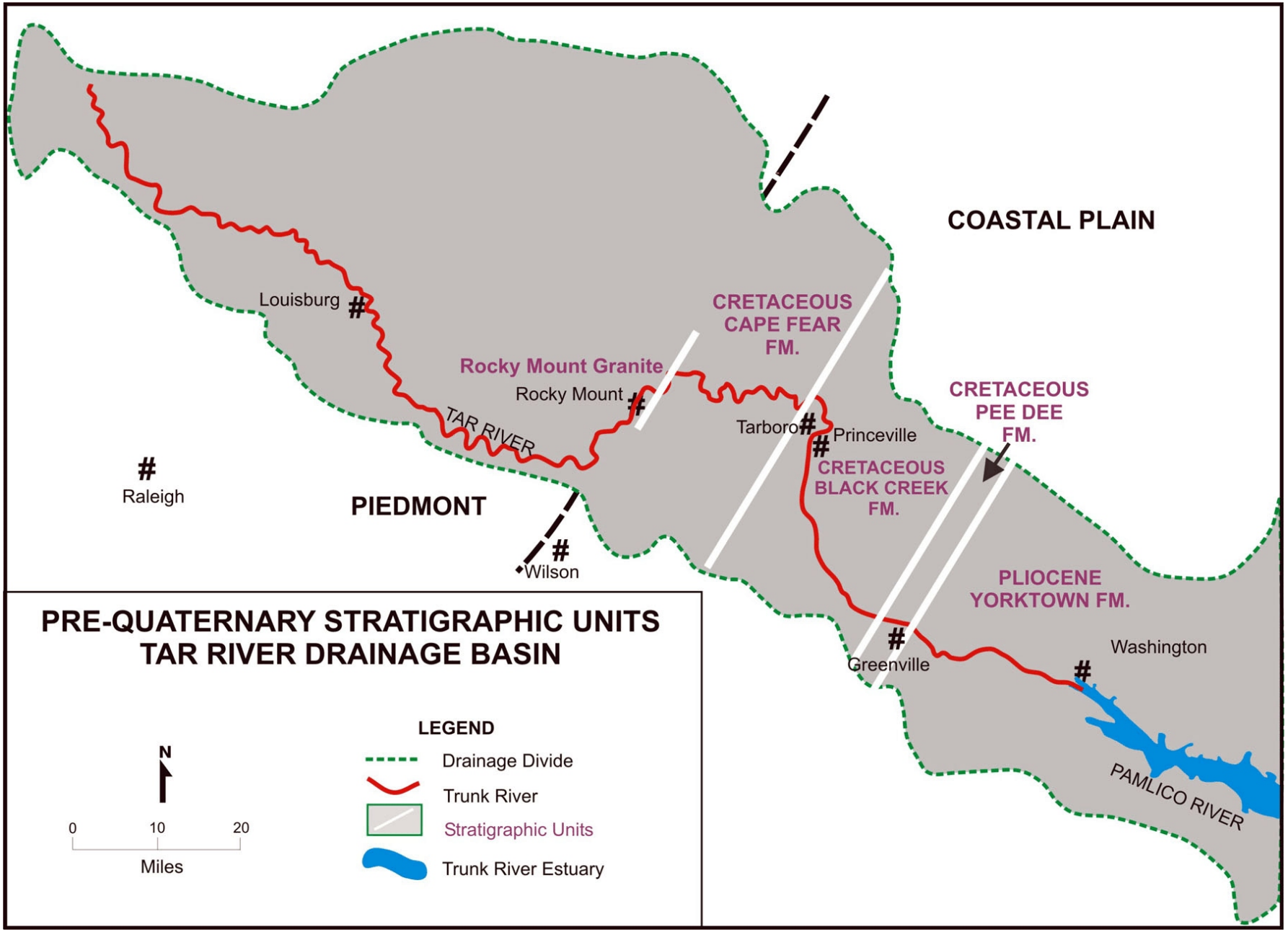


Figure 2. The Tar River appears to vary in sinuosity and orientation with the (theoretical) underlying geology. From Riggs and Ames (2003).

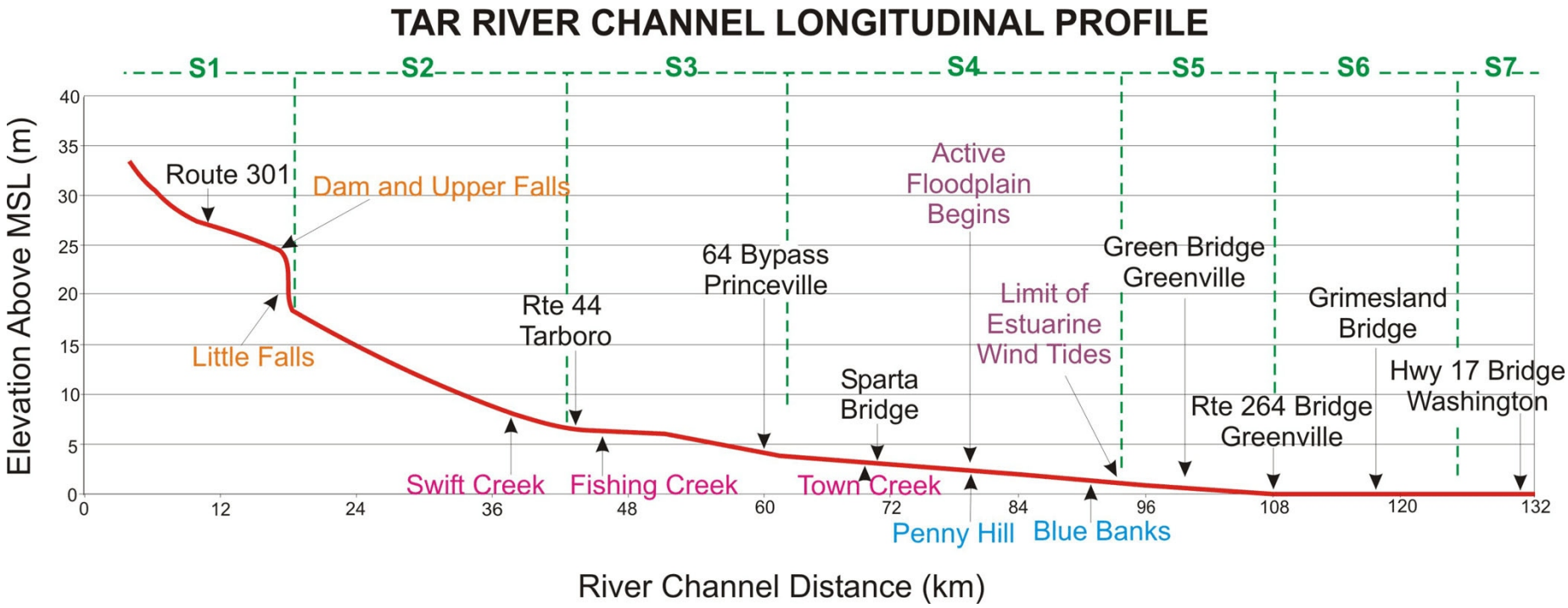


Figure 3. The fall line of the Tar River occurs near Rocky Mount at the Upper and Little Falls, upriver of Princeville. Princeville is located downstream of the confluence of Swift, Fishing and Deep Creeks at an elevation of less than 5 meters (m) above sea level. The Tar River is influenced by estuarine wind tides and a saltwater wedge that reaches as far inland as the Greenville area. From Riggs and Ames (2003).

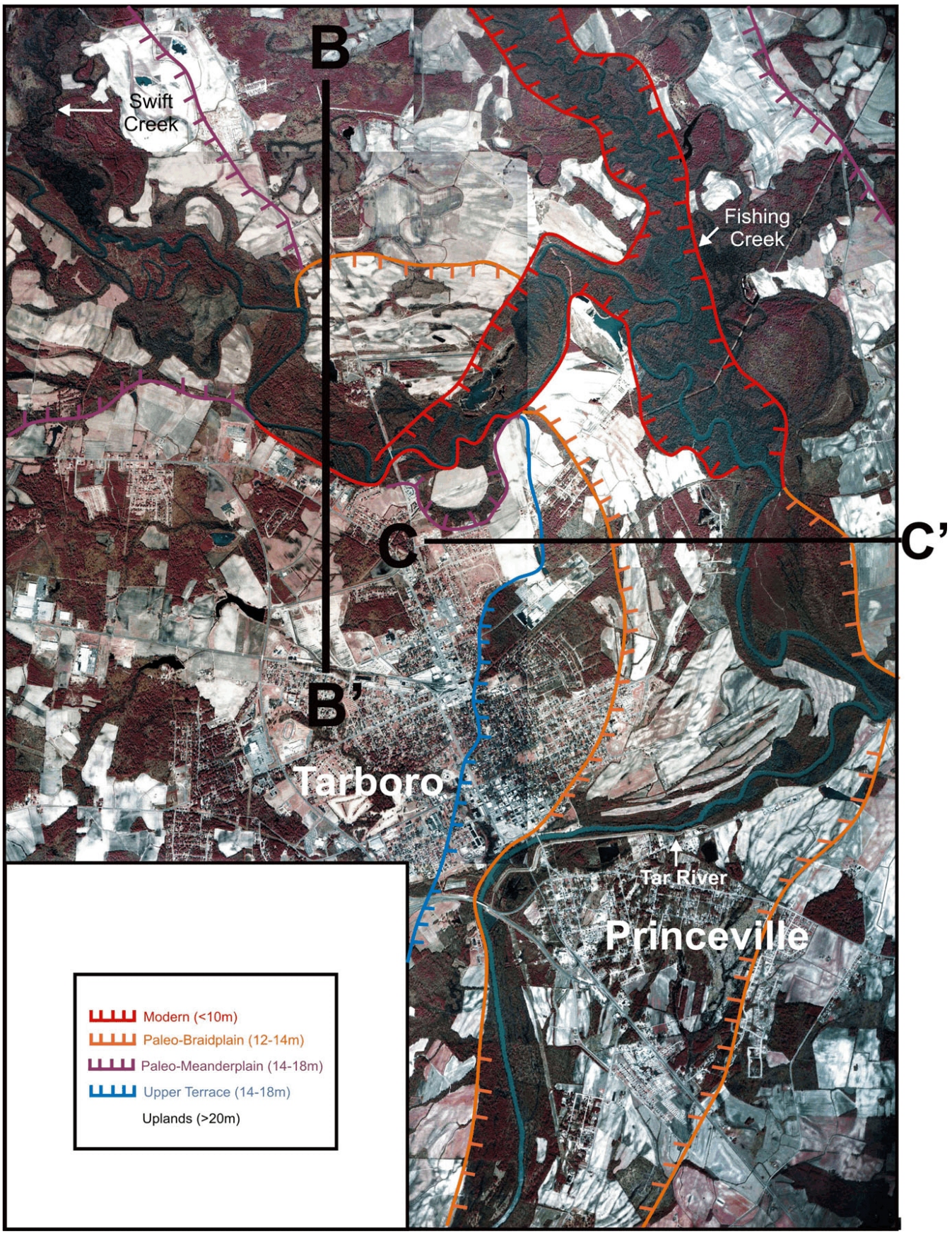


Figure 4. The Tar River floodplain near Tarboro and Princeville is complex with four distinct geomorphic zones that appear to represent different periods of history in the river basin. From Riggs and Ames (2003).

Figure 5. Cross-sections of the Tar River floodplain(s) at Tarboro and Princeville, as located on Figure 4. From Riggs and Ames (2003).

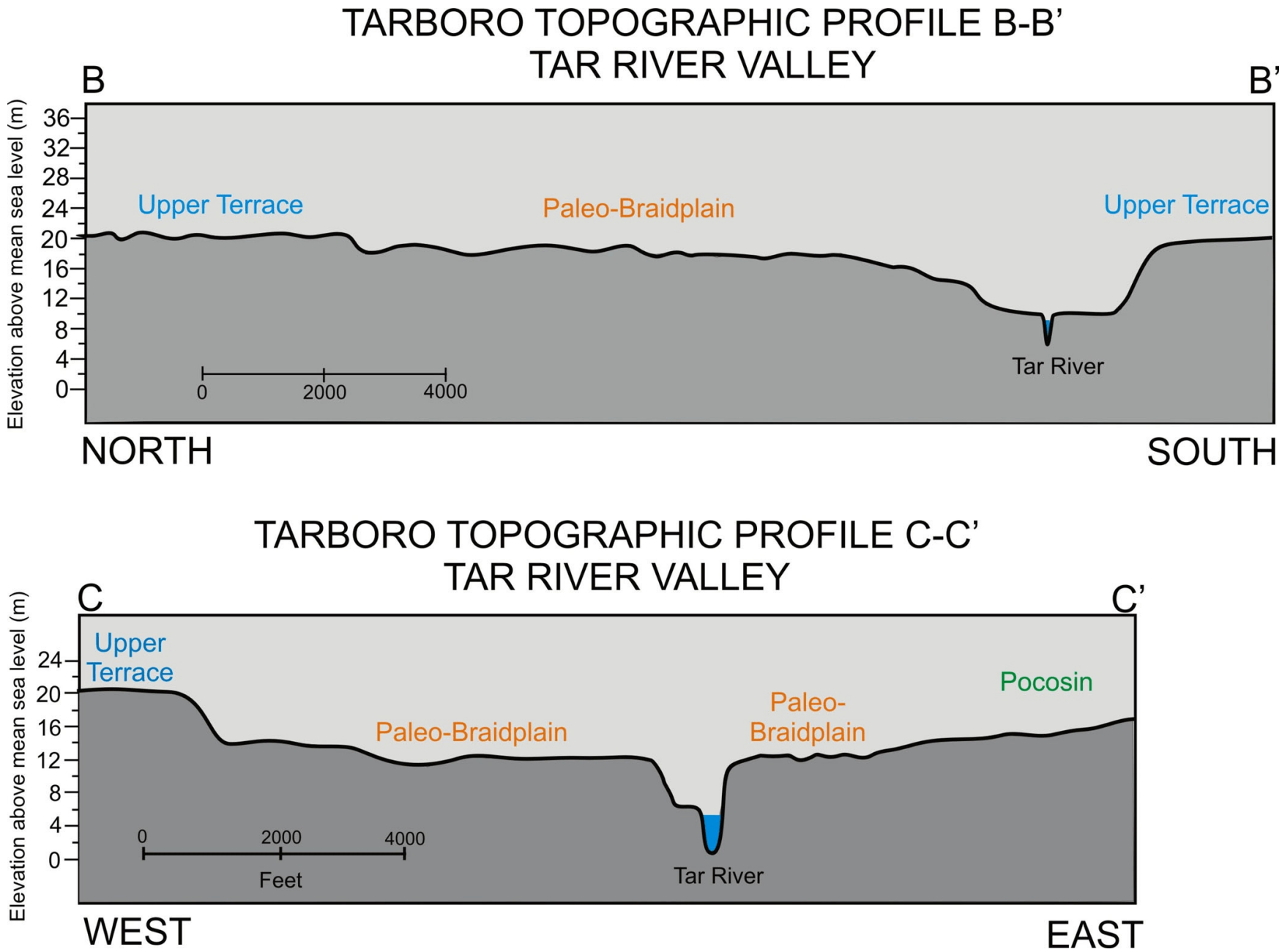
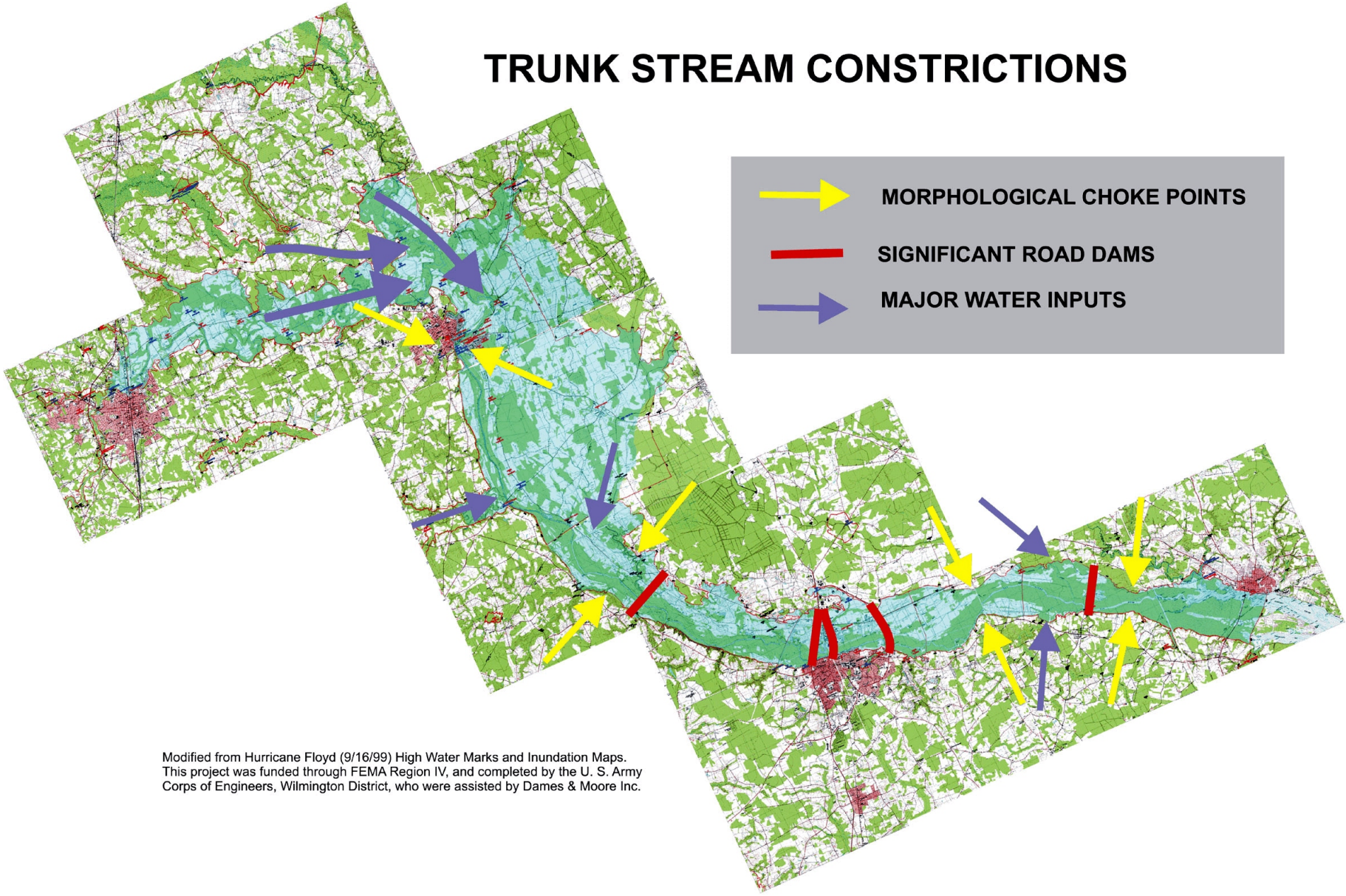


Figure 6. Constrictions on the Tar River floodplain as identified by Riggs and Ames (2003). The September 1999 flood data are from the U.S. Army Corps of Engineers, Wilmington District, and are shown in blue. Princeville is bracketed by the left-most set of yellow arrows.



Section 3. Fish and Wildlife Resource Concerns and Evaluation Methods

The involvement of the Service in this planning process is in response to a Congressional mandate through the FWCA which directs that the conservation of fish and wildlife resources shall receive full and equal consideration and be coordinated with other features of federal water resources development projects. Fish, wildlife, and their habitats are valuable public resources which are conserved and managed for the people by state and federal governments. If proposed land or water developments may reduce or eliminate the public benefits that are provided by such natural resources, then state and federal resources agencies have a responsibility to recommend means and measures to mitigate such losses. In the interest of serving the public, it is the policy of the Service to seek to mitigate losses of fish, wildlife, and their habitats and to provide information and recommendations that fully support the Nation's needs for fish and wildlife resource conservation as well as sound economic and social development through balanced, multiple use of the Nation's natural resources.

Fish and Wildlife Resource Concerns

The purpose of Federal action on Princeville is the reduction of flood damage which is a worthwhile goal. The key issue is the alternatives that will be considered and the extent to which all short- and long-term adverse environmental impacts of each alternative will be weighed in the selection of the preferred alternative. Within the project area, well understood geologic processes driven by encroachment on the floodplain are creating hazardous conditions for man-made structures. As the distance between structures and the river decreases over time, these structures are at greater risk of flood damage. Efforts to protect these structures by putting a flood control structure in the path of the river may provide some temporary protection, but when viewed from a perspective of several decades such measures have little chance of provide long-term protection.

The Service recognizes that Tar River, its tributaries, its floodplains, and the adjacent uplands represent unique and valuable habitats for fish and wildlife resources. Our concern is that these habitat values not be eliminated or degraded. Nationally these habitats are becoming scarcer in their natural, undisturbed form. Therefore, the selection of a method for reducing flood damage should look beyond the short-term advantages or disadvantage of any particular technology and fully evaluate and compare the long-term consequences of each alternative. Any manipulation of sensitive natural areas will be harmful, to some degree, to certain organisms within those habitats. In the past, these manipulations were smaller and impacted a smaller geographical area. Many organisms could simply move to other, less disturbed areas. With increasing development within the Tar River watershed, there may be limited opportunities for animals using riverine habitats to move to nearby, undisturbed areas. In some cases, the species that depend on the river-upland interface are running out of undisturbed options. Therefore, a complete consideration of the cumulative impacts of any construction alternative must be made.

Evaluation Methods

Descriptions of natural resources present within the study area and the preliminary assessment of the environmental impacts of the various alternatives are based on previous studies for similar projects, published literature, and personal communications with knowledgeable individuals. Published reports and studies were examined to determine their relevance to the proposed project. Geographic Information System (GIS) natural resource data were evaluated to identify existing and likely fish and wildlife resources in the project area, and maps illustrating such resources are incorporated as figures where appropriate.

Section 4. Existing Fish and Wildlife Resources

Mid-Atlantic river basins have a diverse vertebrate fauna dominated by birds and fish. Many of these species are dependent on the resources of the river, its tributaries, and its floodplain during all or part of their life cycle or seasonal cycle. The Tar River basin extends from Person County, North Carolina, to the Pamlico River estuary in Beaufort County, North Carolina. The Princeville project area is in the lower half of the river basin, below the fall line of the river (Figure 2). The river basin provides valuable habitat to a variety of fish and wildlife resources.

The North Carolina Natural Heritage Program has identified several Significant Natural Heritage Areas (SNHA) within the vicinity of Princeville. Figure 7 shows the location of these areas, which are listed in Table 1. The primary (active) floodplain of the Tar River has been identified as a SNHA from the eastern Edgecombe County line to the river crossing of NC 97; this includes the floodplain in the immediate vicinity of Tarboro and Princeville. Upstream of the Princeville area, other SNHA include the Swift Creek Swamp Forest, the Shocco Creek/Centerville Bluffs, the Reedy Creek Hardwood Forests, the Fishing Creek/Enfield Bottomland, and several sections of river bank on the main stem of the Tar River in Franklin and Granville Counties.

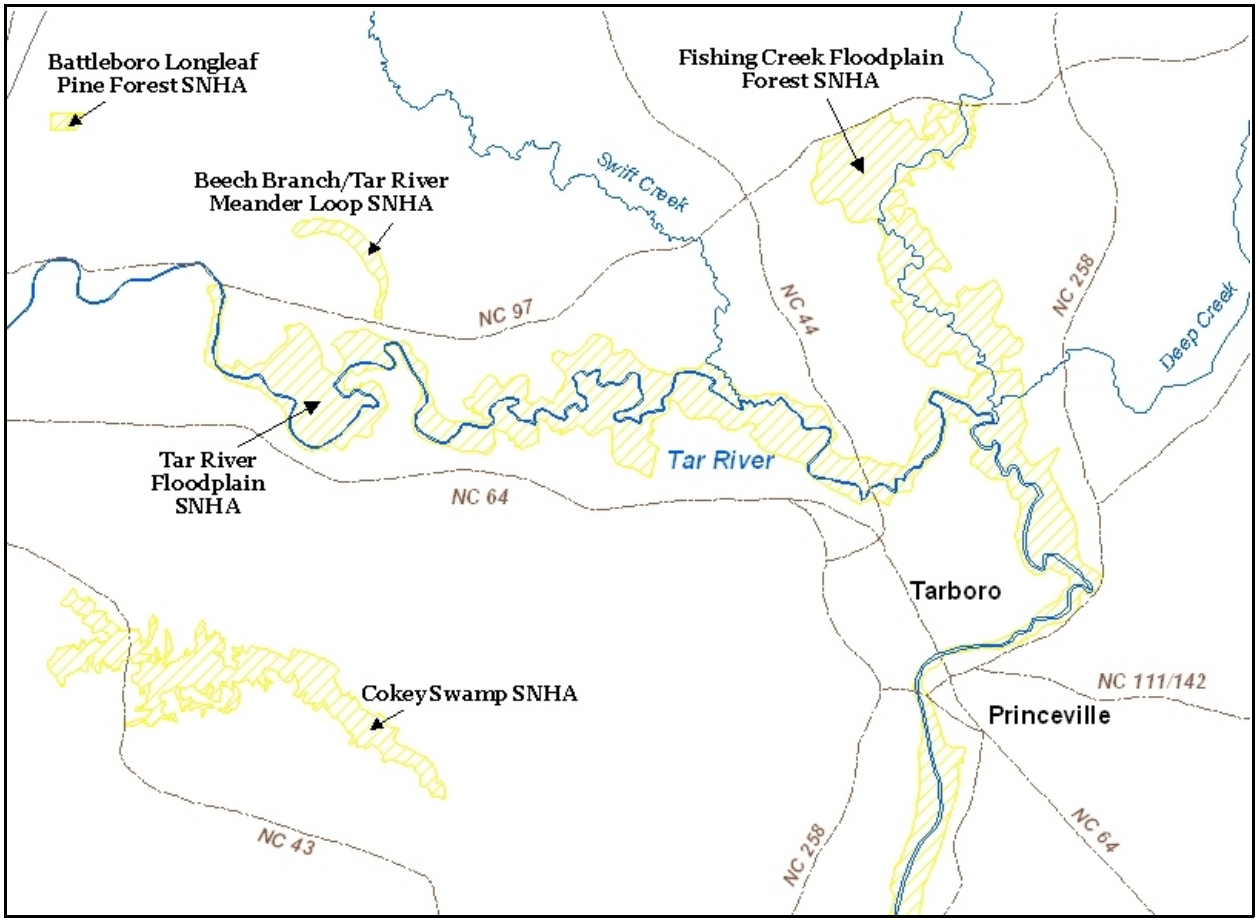
Significant Natural Heritage Areas are a useful planning tool as they identify significant natural resources in a project area. Impacts to these areas should be avoided if at all possible in order to preserve their high habitat value.

The Tar-Pamlico River basin has riparian buffer protection rules that require a 50 foot buffer from each bank of all streams, lakes, ponds and estuarine waters. Both intermittent and perennial streams require the 50 foot buffers. The first 30 feet of the buffer must remain undisturbed, while the last 20 feet are to remain vegetated with certain uses. Some uses are exempt within this zone, some are allowable, some are allowed with mitigation, and others are prohibited. The North Carolina Division of Water Quality (NC DWQ) issues permits for impacts to the riparian buffers. In addition, Swift Creek has recently been designated an Outstanding Resource Water (ORW) by the Division of Water Quality.

Table 1. Significant Natural Heritage Areas (SNHA) as identified by the North Carolina Natural Heritage Program. The name and size of each SNHA is given. See Figure 7 for the locations of each.

SNHA	Area
Tar River Floodplain	10,388 acres
Fishing Creek Floodplain Forest	2,829 acres
Cokey Swamp	2,048 acres
Beech Branch/Tar River Meander Loop	250 acres
Battleboro Longleaf Pine Forest	45 acres

Figure 7. Significant Natural Heritage Areas (SNHA) in the vicinity of Princeville, in Edgecombe County, North Carolina, are shown in yellow hatch marks. These areas have been identified by the North Carolina Natural Heritage Program as having high habitat value for fish and wildlife resources. Major roads are illustrated in dashed brown lines, watercourses in blue, and county lines in gray. Data are from the North Carolina CGIA database.



The Tar River basin provides habitat to a diverse array of fish and wildlife resources. The river and its tributaries, for example, provide spawning habitat for anadromous fish (Figure 8). Diadromous fish that use the Tar River, Fishing Creek, Swift Creek, Deep Creek, and other tributaries include hickory shad (*Alosa mediocris*), American shad (*Alosa sapidissima*), alewife (*Alosa psuedoharengus*), blueback herring (*Alosa aestivalis*), striped bass (*Morone saxatilis*), and American eel (*Anguilla rostrata*).

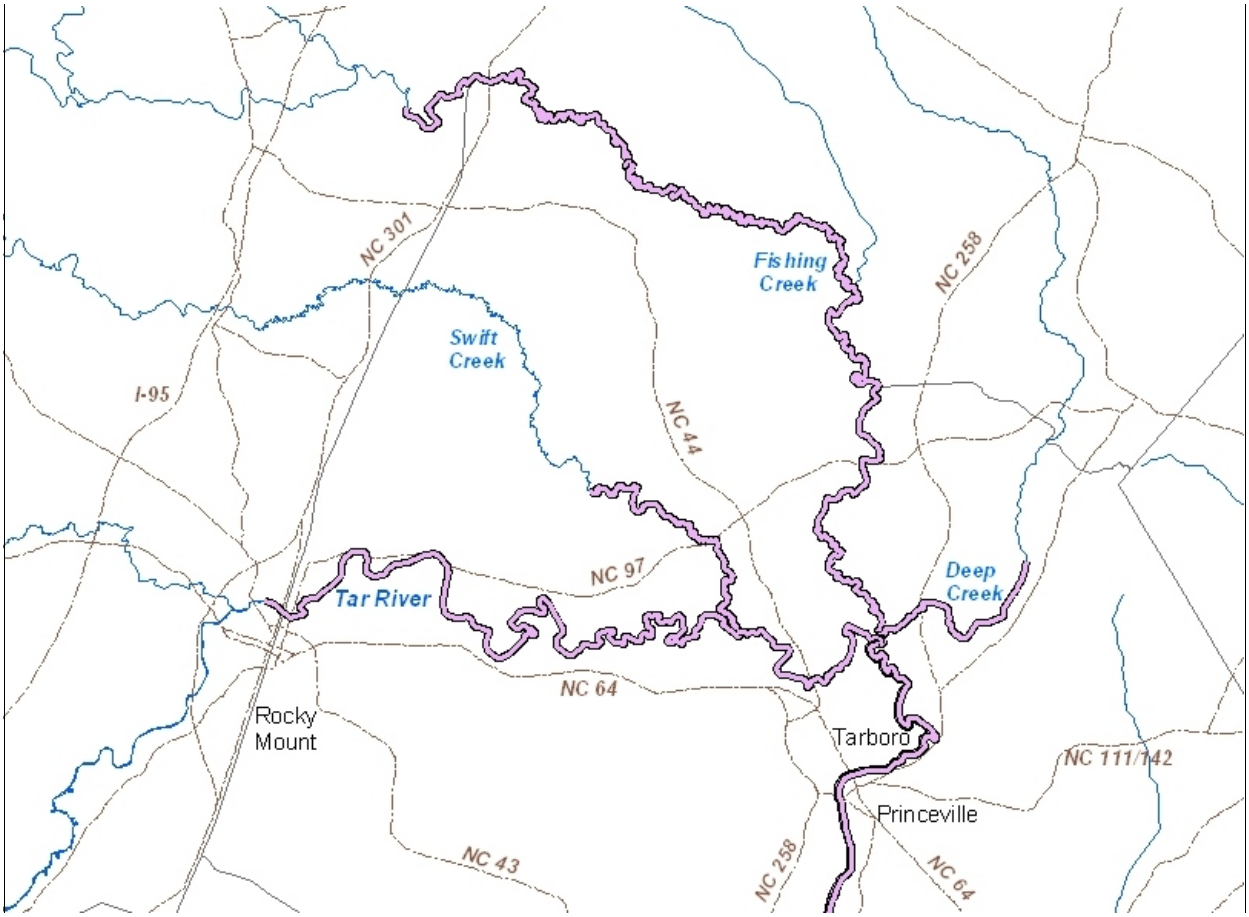
Several species of fish utilize the watercourses of the project area for spawning. These include white perch (*Morone americana),* redbreast sunfish (*Lepomis auritus*), several sucker species, and Roanoke bass (*Ambloplites cavifrons*) (T. Wayne Jones, NC WRC, June 23, 2003, personal communication). Smith and Bayless (1964, p. 15) found that Fishing Creek contained "an excellent population of Roanoke bass, redbreast sunfish, bluegill, and largemouth bass." Deep Creek was found to be "a good fishing stream for redfin pickerel" (Smith and Bayless 1964, p. 15). Swift Creek was noted for its populations of redbreast sunfish, largemouth bass, redhorse suckers, and large channel catfish; its high use by spawning anadromous fish, in fact, led the authors to recommend Swift Creek in Edgecombe County to be categorizes as one of "The Best Fishing Streams" (Smith and Bayless 1964, p. 16).

The Division of Water Quality has monitored and classified the fluvial habitat within the Tar River and many of its tributaries in the Princeville project area (NC DWQ 2003). This monitoring includes biological surveys of macrobenthos and fish, bank erosion and vegetation, fluvial benthic habitat, water quality parameters (e.g., dissolved oxygen, nitrogen), and fish tissue contaminants. The NC DWQ Basinwide Assessment Report, most recently issued in April 2003, should be consulted for historical and existing conditions of riparian resources in the project area.

The project area also provides habitat to terrestrial fish and wildlife resources. The NC Gap Analysis Program predicts suitable habitat for 59 species of birds, 14 mammals, 13 reptiles, and 7 amphibians in Edgecombe County. The avian fauna include large species such as three hawk species, three owl species, American kestrel, and bald eagle. Waterbirds include anhinga, Canada geese, two species of heron, three duck species, pied-billed grebe, least bittern, and osprey. Neotropical migrant species include ten species of warbler (including the Cerulean warbler), sparrows, swallows, finch, flycatchers, gnatcatchers, and others. Northern bobwhite quail habitat is also known or predicted to be present.

The mammalian species for which habitat is predicted in Edgecombe County include two species of bat, black bear, coyote, red fox, Eastern fox squirrel, and others. Of the thirteen reptilian species predicted, two are lizards, nine are snakes and two are turtles. The seven amphibian species are dominated by salamanders (with four of the seven species).

Figure 8. Anadromous fish spawning areas in the Princeville project area as identified by the North Carolina Division of Marine Fisheries, are shown in thick purple lines below. Major roads are illustrated in dashed brown lines, watercourses in blue, and county lines in gray. The main stem of the Tar River provides spawning habitat for anadromous fish from its confluence with the Pamlico River estuary at Washington to approximately the dam near Rocky Mount. The lower reaches of Swift Creek, Fishing Creek, and Deep Creek also provide spawning habitat for anadromous fish. Data are from the North Carolina CGIA database.



State Protected Species

The Tar River drainages in and near the Princeville project area provide valuable habitat for several aquatic species that are endemic to North Carolina. These species include the Neuse River waterdog (*Necturus lewisi*), Carolina Madtom (*Noturus furiosus*), Pinewoods shiner *(Lythrurus matutins*), and Tar River spinymussel *(Elliptio steinstansana)*.

The North Carolina Natural Heritage Program lists species with special status in the project area that include:

Endangered: Tar River spinymussel *(Elliptio steinstansana)*;Yellow lance *(Elliptio lanceolata*); Atlantic pigtoe *(Fusconaia masoni*); and Yellow lampmussel *(Lampsilis cariosa)*

Threatened: Triangle floater (*Alasmidonta undulata*); Roanoke slabshell (*Elliptio roanokensis*); Least Brook lamprey (*Lampetra aepyptera*); Squawfoot (*Strophitus undulatus*); and Eastern lampmussel (*Lampsilis radiata radiata*)

Special concern: North Carolina spiny crayfish (*Orconectes carolinensis*); Neuse River waterdog (*Necturus lewisi*); Notched Rainbow (*Villosa constricta*); and Carolina Madtom (*Noturus furiosus*)

Significantly rare: Roanoke bass (*Ambloplites cavifrons*); a mayfly (*Baetisca becki*); a mayfly (*Baetisca obesa*); and Pinewoods shiner *(Lythrurus matutins*)

Federal Protected Species

The Tar River basin provides habitat for several Federally-listed aquatic species, and several sections of the watershed have been classified as Significant Aquatic Endangered Species Habitat (Figure 9). These species include several species of mussel and one species of fish (Table 2). A brief description of each is included below.

Tar River Spinymussel (*Elliptio steinstansana*)
(description from USFWS Species Accounts, http://nc-es.fws.gov/mussel/tarspiny.html)

The Tar spinymussel, one of only three freshwater mussels in the world with spines, is a medium-sized mussel reaching about 2.5 inches in length. In young specimens, the shell's outer surface (periostracum) is an orange-brown color with greenish rays; adults are darker with inconspicuous rays. The inside of the shell (nacre) is yellow or pinkish at one end and bluish-white at the other. Juveniles may have as many as 12 spines; however, adult specimens tend to lose their spines as they mature. The Tar spinymussel lives in relatively silt-free

Table 2. Aquatic species listed as federally threatened (T), endangered (E), or Federal Species of Concern (FSC) that occur in the Tar River and its tributaries in or upstream of the project area.

Species	Status
Tar spinymussel, *Elliptio steinstansana*	E
Dwarf wedge mussel, *Alasmidonta heterodon*	E
Yellow lance, *Elliptio lanceolata*	FSC
Yellow lampmussel, *Lampsilis cariosa*	FSC
Atlantic pigtoe, *Fusconaia masoni*	FSC
Green floater, *Lasmigona subviridis*	FSC
Pinewoods shiner, *Lythrurus matutins*	FSC

uncompacted gravel and/or course sand in fast-flowing, well oxygenated stream reaches. It is found in association with other mussels, but it is never very numerous. It feeds by syphoning and filtering small food particles that are suspended in the water.

Their method of reproduction is similar among freshwater mussel species. Males release sperm into the water column, and the sperm are taken in by the females through their siphons as they respire. The eggs are fertilized and develop within the females' gills into larvae (glochidia). The females release the glochidia, that must then attach to the gills or fins of specific fish species. The glochida transform into juvenile mussels and drop off the fish onto the stream bottom.

Two relatively good populations of Tar spinymussel are known to exist in two tributaries of the Tar River (Swift Creek and Fishing Creek). Although they have been found in one other tributary, the main stem of the Tar River, individuals are becoming harder to find. This species is endemic to Edgecombe, Johnston, Nash, Franklin, Halifax and Warren Counties in North Carolina.

Dwarf wedge mussel (*Alasmidonta heterodon*)
(description from USFWS Species Accounts, http://endangered.fws.gov/i/f/saf12.html)

The dwarf wedge mussel's shell rarely exceeds 1.5 inches in length. It's also the only North American freshwater mussel that has two lateral teeth on the right valve, but only one on the left (Fuller, 1977). The female's shell is inflated in the back where the marsupial gills are located. Little is known about the species' life history and reproductive cycle. Gravid females have been observed from late August until June (Clarke, 1981). Like other freshwater mussels, this species' eggs are fertilized in the female as sperm passes through its gills; the resulting larvae than

attaches to a fish host. Although this host is still unknown, strong evidence suggests that it is an anadromous fish which migrates from the ocean into freshwater to spawn.

Once known from about 70 Atlantic Slope river systems, the dwarf wedge mussel is now known from only 12 sites. Four of the existing populations are located in North Carolina – one in the Little River (Johnston County); another on the Tar River (Granville County); and one each in two tributaries of the Tar River (Franklin County). The remaining populations occur in Maryland, New Hampshire, and Vermont (Department of the Interior, 1990).

Historically, this mussel occurred in 11 States and one Canadian province. It ranged from the Petitcodiac River system in New Brunswick, Canada south to the Neuse River System in North Carolina. Now, the dwarf wedge mussel is extirpated from both river systems. Other former Southeastern river system sites include the Choptank River; the Rappahannock River; and the James River. In the Middle Atlantic states, the dwarf wedge inhabited the Hackensack River; the Delaware River; and the Susquehanna River systems. New England habitat sites included the Taunton River, the Agawam River, the Merrimac River, the Connecticut River, and the Quinnipiac River systems. One other population from the Fort River in Hampshire County, Massachussetts, also appears extinct (Department of the Interior, 1990).

The dwarf wedge mussel inhabits creek and river areas with a slow to moderate current and a sand, gravel, or muddy bottom. These areas must be nearly silt free.

Water pollution and the construction of impoundments are the primary threats to this mussel's survival. Increased acidity, caused by the mobilization of toxic metals by acid rain, is thought to be one of the chief causes of the species' extirpation from the Fort River in Massachussetts (Department of the Interior, 1990). One of the largest remaining populations has declined dramatically in the Ashuelot River, downstream of a golf course. This population probably has been affected by fungicides, herbicides, insecticides, and fertilizers which have been applied to the golf course. Agricultural runoff from adjacent corn fields and pastures also is contributing to this population's decline (Masters, 1986). Freshwater mussels, including the dwarf wedge, are sensitive to potassium, zinc, copper, cadium, and other elements associated with industrial pollution (Havlik and Marking, 1987). Industrial, agricultural, and domestic pollution is responsible for the dwarf wedge's disappearance from much of its historic range. To survive, the dwarf wedge needs an almost silt free environment with a slow to moderate current. The construction of dams alters these conditions. For example, most of the Connecticut River's main stem is now a series of impoundments. Upstream from each dam, heavy silt disposition, combined with low oxygen levels, has made the area unsuitable for mussels. Downstream of the dams, water level and temperature fluctuations, caused by hypolimnetic discharges and intermittent power generation, have been stressful to the mussels. In some areas below the dams, the river banks have stabilized and the dwarf wedge's required substrate (sandy, gravel, or muddy) no longer exists.

Another reason the species is declining is because its anadromous fish host has been blocked

from some habitat areas. For example, the Petitcodiac River system in Canada still hosts several rare mussels, but the dwarf wedge has disappeared. Apparently a downstream water causeway, constructed since the species was last seen, has denied access to the fish host. Populations in the species' remaining range are suffering a decline in reproductive capacity because of its low numbers and isolated population distribution.

The Maryland Natural Heritage Program has started a program to surround creeks with natural vegetated buffer strips. These strips, which are being established through voluntary landowner cooperation, will protect dwarf wedge habitat by filtering out sediment, excess nutrients, and pollutants (McKnight, 1989). Planned recovery efforts throughout the species' range include encouraging the development of mussel sanctuaries, and reintroducing the species into suitable historic habitats. Recovery of the dwarf wedge mussel calls for buffer strips, conservation easements, and other protective measures through management agreements with local, State and Federal government authorities and private landowners. Also, dwarf wedge mussel ecology and life history should be studied, and periodic population surveys conducted at historic and existing sites. It's also essential to determine the identity of the species' fish host(s).

Yellow lance (*Elliptio lanceolata)*
(description from Bogan 2002, p. 43)

"The yellow lance is known from the Tar, Roanoke, James, and Rappahannock drainages (A. Gerberich, pers. comm.) (Adams et al., 1990)."

"This elongate, freshwater mussel grows to approximately 86 mm long. Shells are over twice as long as tall. The periostracum is usually bright yellow over the entire surface in younger individuals. Older individuals may have a brown discoloration at the posterior end of the shell. (Uniformly brown individuals are also found; however, yellow and brown individuals are not found at the same stations.) The nacre may range from salmon to white to an iridescent blue color. The posterior ridge is distinctly rounded and curves dorsally toward the posterior end. Rays are usually never present; however, one individual has been observed with three wide, prominent green rays on the posterior third of the shell in the Tar River Drainage Basin (Adams et al., 1990). Brownish growth rests are clearly evident on the periostracum. The pallial line and adductor muscle scars are distinct. The posterior adductor muscle scars are less impressed than the anterior adductor muscle scars. The lateral teeth are long - two on the left valve and one on the right valve. Two pseudocardinal teeth are on each valve. On the left valve one is before the other with the posterior tooth tending to be vestigial. On the right valve, the two pseudocardinal teeth are parallel with the more anterior one rather vestigial. (Adams et al., 1990)"

"*Elliptio lanceolata* prefers clean, coarse to medium size sands as substrate. On occasion, specimens are also found in gravel substrates. This species is found in the main channels of drainages down to streams as small as three feet across. Gravid females have been found in the Tar River Drainage Basin in June (Alderman, unpubl. data). As verified by Tankersley (1988),

the glochidia are hookless. The fish host for this species has not been determined."

"Williams et al. (1993:11) listed [the yellow lance] as endangered. The existence of the Yellow Lance in the Roanoke Drainage Basin has not been verified in recent years. In the Tar River, this species has declined (Alderman 1988) since A. Clarke (1983) completed his survey for the Tar River spiny mussel (Adams et al., 1990). This species is listed as State Endangered effective July 1, 2002."

Yellow lampmussel (*Lampsilis cariosa*)
(description from Bogan 2002, p. 53)

"The Yellow Lampmussel extends from the Ogeechee River Basin, Georgia, north to Nova Scotia and Cape Breton Island, and westward in the St. Lawrence River Basin to the lower Ottawa River drainage and the Madawaska River (Johnson, 1970). ... This species is known from the Pee Dee, Waccamaw, Cape Fear, Neuse, and Pamlico basins (Johnson, 1970). "

"Shell shape [of the yellow lampmussel] is obovate, shell thickness begins as thin in juveniles becoming thicker with age, moderately inflated, shell length 120 mm. Anterior margin is rounded, ventral margin slightly curved, posterior margin bluntly rounded. Male shells elliptical and somewhat elongate in outline with the ventral margin evenly convex. Female shells are subovate to obovate in outline with the ventral margin expanded near the posterior margin, sloping up to a very bluntly rounded posterior margin. Posterior ridge is poorly developed and rounded, posterior slope slightly convex to flat. Beaks moderately swollen but not elevated much above the hingeline, located anterior of the middle of the shell, beak sculpture consist of about five poorly defined bars, the first ridge concentric with the remainder slightly double-looped. Periostracum is waxy and shiny. Left valve with two compressed pseudocardinal teeth, the posterior tooth low and immediately under the umbo, two delicate lateral teeth. Right valve has a single compressed pseudocardinal tooth, and a single lamellar lateral tooth. The pseudocardinal teeth tend to become more stumpy and ragged with age. Interdentum is practically absent, the beak cavity is open and moderately deep. Periostracum is waxy yellow, often with a trace of green in it, rays are either absent or restricted to the posterior slope or slightly in front of it. The rays are variable in width, but usually thin, sharp and dark green to black, contrasting with the yellow of the background. Older specimens become brownish and loose much of the luster. Nacre color bluish-white, often tinged with cream or salmon.

"Ortmann (1919) observed that gravid females were seen in August, with glochidia appearing only in late August. The species is bradytictic, releasing glochidia in the following spring or early summer. The Yellow Lampmussel is found in medium to larger rivers often in sand in bedrock cracks, but also is found in silt, sand, gravel, and cobble substrates. Wick and Huryn (2002) have identified the Yello Perch (*Perca flavescens*) and the White Perch (*Morone americana*) as host fish for the Yellow Lampmussel in Maine."

Atlantic pigtoe (*Fusconaia masoni*)
(description from Bogan 2002, p. 51)

"The Atlantic Pigtoe ranges from the Ogeechee Drainage Basin, Georgia north to the James Drainage Basin, Virginia. In North Carolina, this species was once found in every Atlantic drainage except the Cooper-Santee and Waccamaw drainage basins (Johnson 1970). ... This species is [currently] known from the Catawba, Pee Dee, Cape Fear, Neuse, Pamlico, and Roanoke River basins (Aarons Creek) (Johnson, 1970)."

"Atlantic Pigtoes are sub-rhomboidal except in individuals from headwater areas. Such individuals tend to be more elongate. The posterior ridge is very distinct, and the umbos extend well above the dorsal margin. The periostracum is yellow to dark brown and parchment like. The nacre ranges from an iridescent blue, to salmon, to white, to orange. Pseudocardinal and lateral teeth are well developed except for the anterior pseudocardinal tooth in the right valve, which is vestigial. All four demibranchs serve as marsupia in gravid females. As the glochidia mature, the demibranchs and adductor muscles develop a bright orange-red to red color. Additional species descriptions can be found in Johnson (1970) and Fuller (1973)."

"The preferred habitat for the Atlantic Pigtoe is a yielding substrate composed of coarse sands and gravel at the downstream edge of riffle areas. In such habitats, which are becoming increasingly rare since sedimentation significantly affects such areas, as many as five live individuals have been found in a one-meter square area. This species is less common in sands, cobble, and mixed substrates of sand, silt, and detritus. Little is known about other aspects of its life history or ecology (Adams et al., 1990). Watters and O'Dee (1997) identified the Bluegill (*Lepomis macrochirus*) and the Shield Darter (*Percina peltata*) as potential fish hosts for *Fusconaia masoni* glochidia.**"**

Green floater (*Lasmigona subviridis*)
(description from Bogan 2002, p. 60)

"[The general distribution of the green floater includes the] New and Greenbrier rivers of the upper Kanawha River drainage, Virginia and West Virginia. Upper Savannah River system of South Carolina north to the Hudson River system, and westward through the Mohawk River and the Erie Canal to the Genesee River of New York (Johnson, 1980; Clarke, 1985)."

"This small species is known [in North Carolina] from the Watauga and New river basins in western North Carolina and the Roanoke (Dan River), Tar, Neuse, and Cape Fear River basins in eastern North Carolina (Walter, 1954; Clarke, 1985; Shelley, 1987; Adams et al., 1990; T. Savidge, Pers. Comm. March 2002)."

"The shell [of the green floater] is thin and slightly inflated; it is subovate, narrower in front,

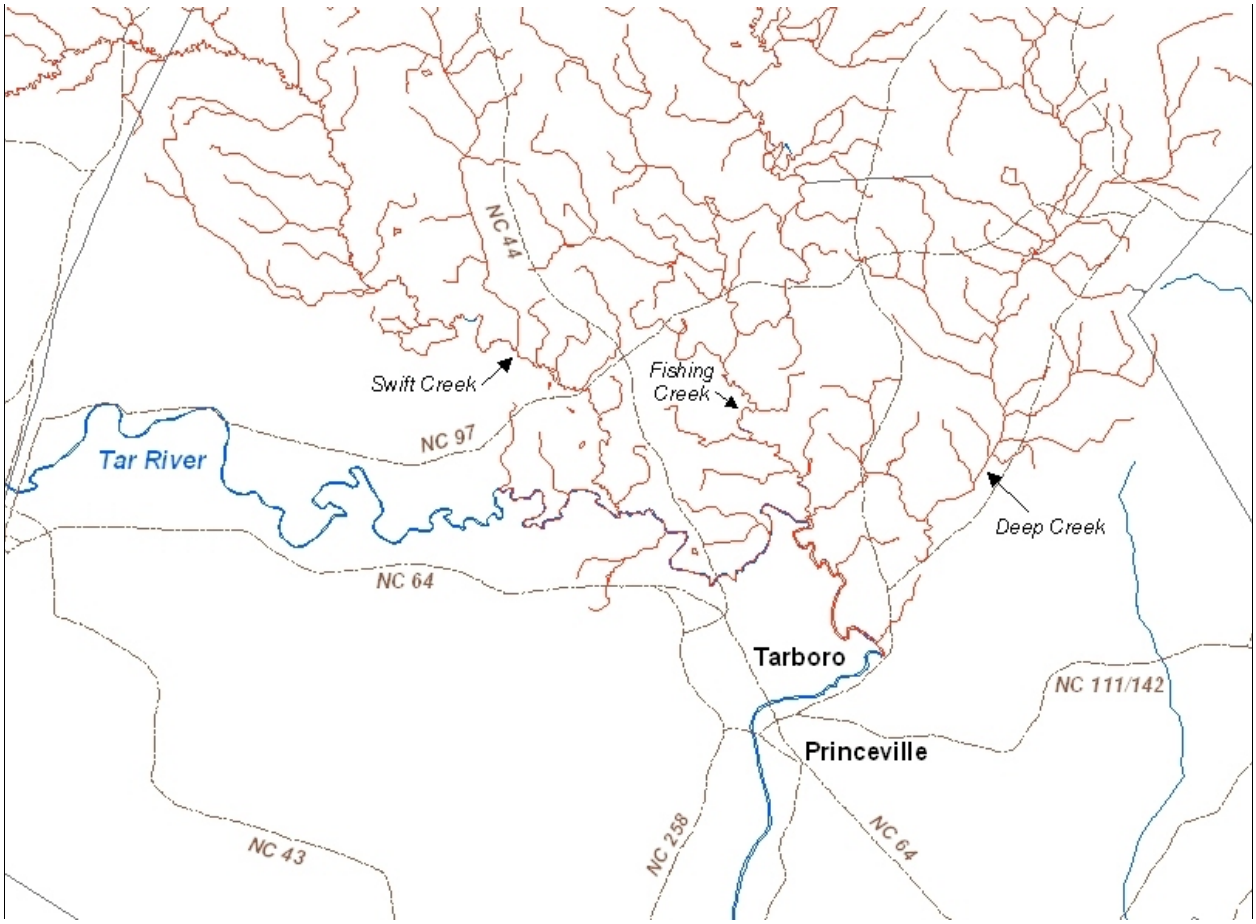
higher behind, and the upper margin forms a blunt angle with the posterior margin (Ortmann, 1919). The posterior ridge is low, rounded, and appears more as a slight swelling than as a ridge. Beaks are low and not extended beyond the hinge line; sculpture consists of 4–5 nodulous bars, the first two concentric, the others deeply double-looped (Johnson, 1970). Mature individuals reach a length of about 60 mm. The lateral teeth, one in the right valve, two in the left, are long, straight, and thin. The left valve has two lamellate pseudocardinal teeth, and the right valve has one; pseudocardinals are directed forward of the beak and nearly parallel with the hinge line. The periostracum is a dull yellow or tan to brownish green, with variable concentrations of dark green rays. The nacre is a dull bluish white, often with mottled shades or tints of salmon in the general beak cavity area (Parmalee and Bogan 1998:145)."

"Ortmann (1919:124) noted that *Lasmigona subviridis* is 'adverse to very strong current, and prefers more quiet parts, pools or eddies with gravelly and sandy bottoms, and it also goes into canals, where it seems to flourish.' Pockets of sand and gravel among boulders provide a habitat for this mussel although it appears to be uncommon and localized. Ortmann (1919) stated that this species is normally hermaphroditic, and that it is bradytictic, with the reproductive season extending from August to May. Barfield and Watters (1998) reported direct development for the juveniles of the Green Floater. This is the only recently confirmed non-parasitic development for a North American unionid."

Pinewoods shiner (*Lythrurus matutins*)

The pinewoods shiner is endemic to North Carolina and is only known to inhabit the Neuse and Tar River basins. Within the Princeville project area, this fish is present in Fishing Creek, Swift Creek, White Oak Swamp (a tributary to Swift Creek), and the main stem of the Tar River.

Figure 9. The three major tributaries to the Tar River in Edgecombe County have all been identified as Significant Aquatic Endangered Species Habitat by the North Carolina Wildlife Resources Commission (shown in red). The entire Swift Creek, Fishing Creek and Deep Creek watersheds are classified as Significant Aquatic Endangered Species Habitat, as is the main stem of the Tar River between Fishing Creek and an unnamed tributary near Shiloh Mills northeast of Princeville. Major roads are illustrated in dashed brown lines, watercourses in blue, and county lines in gray. Data are from the North Carolina CGIA database.



Section 5. Potential Alternatives

The Corps has identified a range of alternatives for flood control along the Tar River between Rocky Mount and Princeville, North Carolina. These alternatives include:

1) No Action.

2) Relocation of homes vulnerable to flooding.

3) Modification of the Princeville levee.

4) High flow bypass channel or floodway to divert flood waters away from communities.

5) Upstream reservoir(s) to control river flow, provide flood damage reduction, provide water supply, and provide recreational opportunities.

6) Modification of bridge and/or railway structures across the floodplain.

7) Modification to the Tar River channel.

Section 6. Environmental Impacts of Action Alternatives

If Federal action is taken to reduce flood damage of Princeville, the single greatest determinant of the environmental impacts of efforts will be the alternative selected to achieve this goal. As part of the coordination mandated by the FWCA, the Service offers the following outline of the environmental impacts that could result from the major alternatives. This outline and the supporting material should be used by the Corps in developing and assessing the impacts of these alternatives.

The Service scoping letter of February 26, 2001, recommended that the environmental impacts analysis for the Princeville flood control project evaluate the impacts from the Cotton Mill dam in Rocky Mount downstream to the Pamlico River estuary in Washington. The use of the river by diadromous fish and host species for mussel glochidia rely upon clear fish passage between these two limits and all tributaries in between.

All of the river basins within the Albemarle-Pamlico drainage system are hurricane-prone and experienced widespread flooding in 1999. The 1999 flooding was recorded in detail and data are available for base flows, wind tides, precipitation patterns, runoff and the extent and duration of flooding in various parts of the lower river basin. Flood damage reduction efforts represent an uncommon opportunity for restoration, mitigation and preservation projects.

The project development and engineering design should be based upon the high resolution digital topography taken of the area following the 1999 storms; this data is produced by the state of North Carolina and would identify existing hydrologic pathways and opportunities for restoration and enhancement. While a flood bypass system to the east of Princeville may take advantage of the natural flow of floodwaters entering the Tar River from Swift and Fishing Creeks, the paleo-braidplain habitats in that area are likely to contain significant amounts of wetlands that would require compensatory mitigation. A large and substantial levee on the east side of Princeville might be necessary to protect Princeville from floodwaters of the bypass channel, effectively creating a closed basin that could flood through groundwater input and increase stormwater management issues. Raising the existing dike in Princeville would not alleviate flooding that presently occurs from the east (Figure 6).

Alternatives that utilize dams, upstream reservoirs, or channel modifications are likely to generate significant impacts to fish and wildlife resources and not be supported by the Service. Modification of the Rocky Mount dam for flood control purposes would not control for the discharges of the two largest tributaries of the Tar River (Swift and Fishing Creeks), which drain into the Tar downriver of the existing dam. The Service generally supports the removal of existing dams rather than the construction of new ones due to their significant ecological impacts.

Given the highly valuable aquatic endangered species habitat present in the project area, the environmental impacts from the flood control alternatives under consideration are likely to be

significant. The town of Princeville is historically significant. The cumulative impacts to the aquatic and riparian system of the Tar River and its tributaries may be significant to fish and wildlife resources. An environmental impact statement is appropriate for this project to fully evaluate the potential impacts to both the human environment (the historic town of Princeville) and the fish and wildlife resources.

The Corps planning effort should consider the differences in the environmental impacts of the major action alternatives. The assessment should balance the environmental positives of each alternative against the environmental harm of that course of action. The potential harm of long-term and cumulative adverse impacts should receive greater consideration than short-term harm.

Section 7. Fish and Wildlife Conservation Measures and Service Recommendations

The information provided above on environmental impacts is intended to assist the Corps in achieving the objectives of the FWCA by giving fish and wildlife resources equal consideration with other aspects of water resources development. As planning moves forward the Service offers the following recommendations to achieve the worthwhile goal of storm damage reduction while protecting the important environmental quality important to the residents of Princeville.

Overall, fish and wildlife resources on and near Princeville and the Tar River will be conserved by a project design that takes advantage of the natural conditions and processes in the watershed. Modifications to the Swift and Fishing Creek watersheds should be avoided due to their very high value to Federally and state-listed aquatic species and anadromous fish. Blockages of fishery resources (both non-game host species for mussels and game species) migrating up and downstream between the Tar River and these tributary watersheds should also be avoided. Many aquatic species in the project area are endemic to the Tar and Neuse River basins, and as such should receive high priority for protection in all project designs.

Furthermore, the planning process should fully consider that an alternative that minimizes adverse impacts to fish and wildlife resources could involve a join effort of several Federal agencies. While the historic significance of Princeville should be preserved, recent guidance from the Corps and Congress outlines new economic evaluation techniques for relocation alternatives. Non-traditional funding sources such as the new Corps floodplain buyout program, hazard mitigation grants from the Federal Emergency Management Agency, and stream restoration projects of the Natural Resources Conservation Service could be utilized for a non-structural alternative. Elevation of all of the structures within Princeville above the level of flooding experienced in 1999, akin to the elevation project in Belhaven in Beaufort County, could maintain the historic integrity of the town and reduce flood damages.

The Service can support a project if it (1) is ecologically sound; (2) is the least environmentally damaging alternative; (3) has avoided and minimized damage or loss of fish and wildlife resources and uses; (4) has adopted, with guaranteed implementation, all important recommended conservation measures to satisfactorily compensate for unavoidable damage or loss to fish and wildlife resources; and (5) is clearly a water dependent activity with a demonstrated public need if there are wetland or shallow water habitats in the project area (January 23, 1981, Federal Register v. 46, n. 15, p. 7659).

The Service recommends that removal of artificial constrictions on the floodplain as an alternative that is likely to be the least environmentally damaging. By replacing road dams with bridges, for instance, the natural capacity of the floodplain(s) to convey floodwaters will be restored. Fragmented riparian habitats could be restored as well. The 50 foot buffer requirements on the Tar River and its tributaries could be maintained and/or restored to enhance water quality and fish and wildlife habitat quality. The increased capacity of the floodplain(s) to convey floodwaters should significantly decrease the duration of flooding events, and potentially

the height of floodwaters in some communities.

A recent project that may serve as an example is the replacement of the bridge across the Tar River at Grimesland in Pitt County. The North Carolina Department of Transportation has recently selected a high rise bridge that will allow the entire primary floodplain to pass under the bridge. The existing Grimesland bridge may be one of the largest road dams on the Tar River, and its replacement with a high rise bridge is likely to reduce flooding downstream of Greenville (Riggs and Ames 2003)

Inclusion of Service in Planning Effort

Fulfilling of the "equal consideration" requirements of the FWCA would be facilitated by the participation of the Service in Corps planning meetings, internal scoping meetings, team meetings, In Progress Reviews (IPR) (weekly via phone or monthly in person). The Corps should also give the Service the opportunity to participate in any Alternative Formulation Briefing (AFB) and/or Feasibility Review Conference (FRC) with Corps SAD and WO representative prior to the release of the draft feasibility document to ensure our concurrence as required by ER 1105-2-100 Planning Guidance.

Section 8. Summary

The Service recognizes the need for flood damage reduction and fully supports Federal action to achieve this goal if the long-term viability of fish and wildlife resources are fully considered in the selection, design, and implementation of an action alternative. The consideration of fish and wildlife resources should not be limited to easily defined monetary values, but include the social functions and values which these resources contribute to the quality of life in Princeville and surrounding areas.

This report provides planning aid information on the fish and wildlife resources in the project area, the potential adverse impacts of major action alternatives, and actions which the Service believes would serve to minimize adverse impacts. The most critical aspect of any Federal action will be the selection of a preferred alternative for reducing flood damages. We hope that the environmental resources presented in this report will be incorporated into the ongoing planning process.

The Service appreciates this opportunity to contribute to the early planning of this project. The Service is ready to expand upon the important issues raised in this PAR and discuss these issues at plan formulation meetings that may occur prior to the release of the Draft Environmental Impact Statement.

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